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This publication gives information on new developments of interest to agriculture on laboratory and field investigations of the du Pont Company and its subsidiary companies.

In addition to reporting results of the investigations of the Company and its subsidiaries, published reports and direct contributions of investigators of agricultural experiment stations and other institutions are given dealing with the Company's products and other subjects of agricultural interest.

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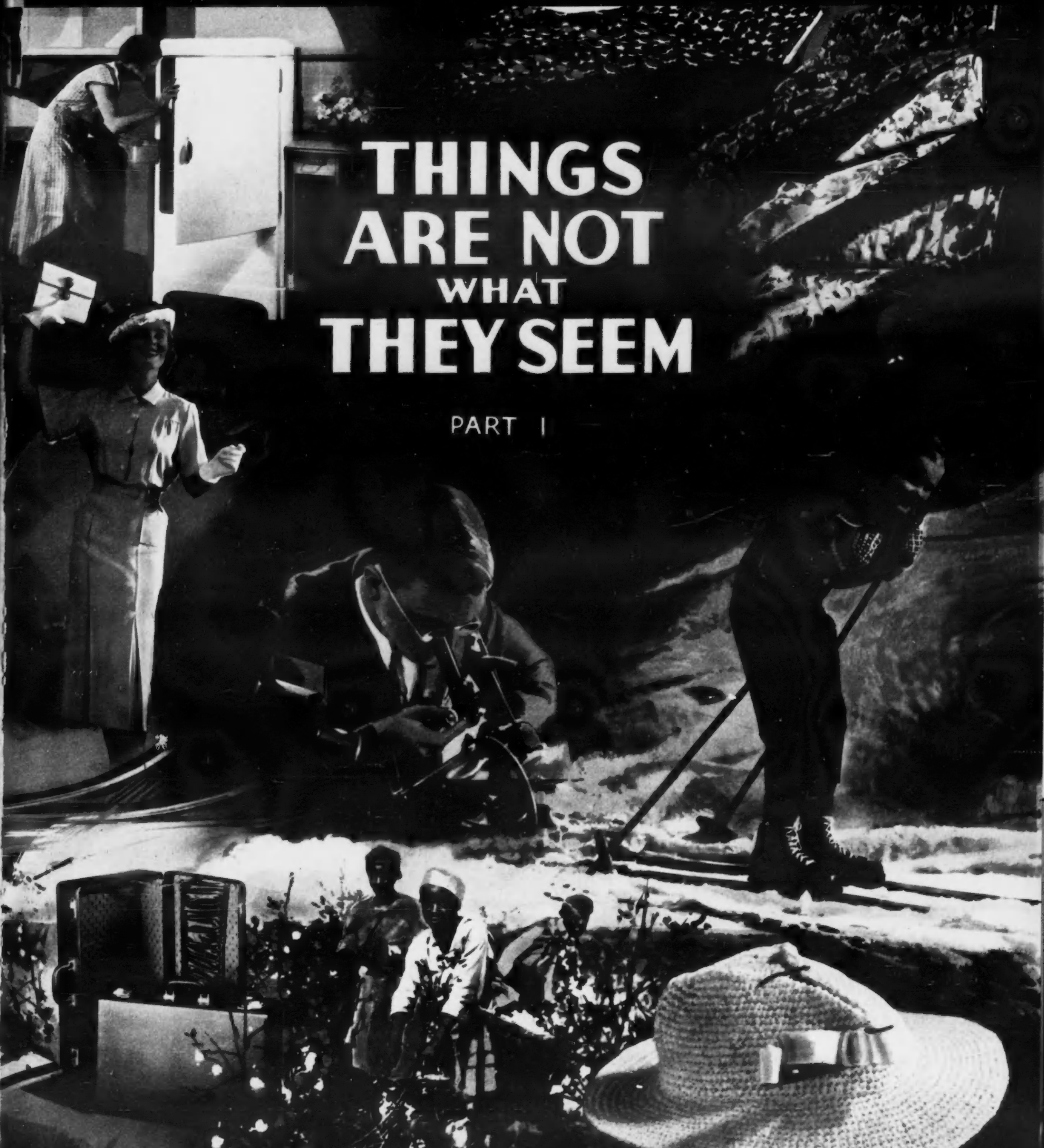
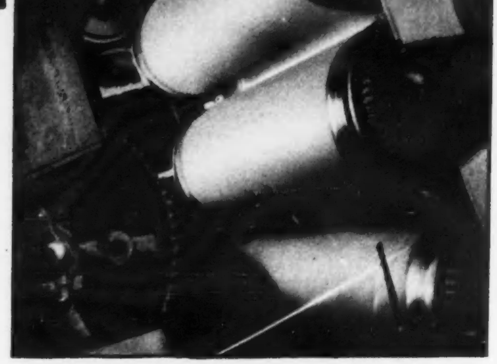
THINGS ARE NOT WHAT THEY SEEM

PART I





RESEARCH chemist at work in experimental station of the du Pont company. Right, cellulose solution, dyed the desired color, is coated on a cotton textile base, the surface is embossed to give the grain or finish desired—and the result is an endless sheet of "Fabrikoid."

Photographs courtesy E. I. du Pont de Nemours and Company

By H. W. MAGEE

MOTHER NATURE had a rare sense of humor. She provided man with the materials to produce virtually anything his mind could conceive—but she omitted the labels.

She scrambled, concealed and disguised her gifts with diabolical cunning. In a lump of coal, for instance, she hid the materials for beautiful dyes and rare perfumes. In a spruce tree and the cotton boll she secreted the substance of a shimmering fabric, a lacquer for your car or a handle for your toothbrush. She placed all her treasures in three great storehouses—the earth, the sea and the air—and challenged man to fit together the jumbled pieces of the colossal jigsaw puzzle she had created.

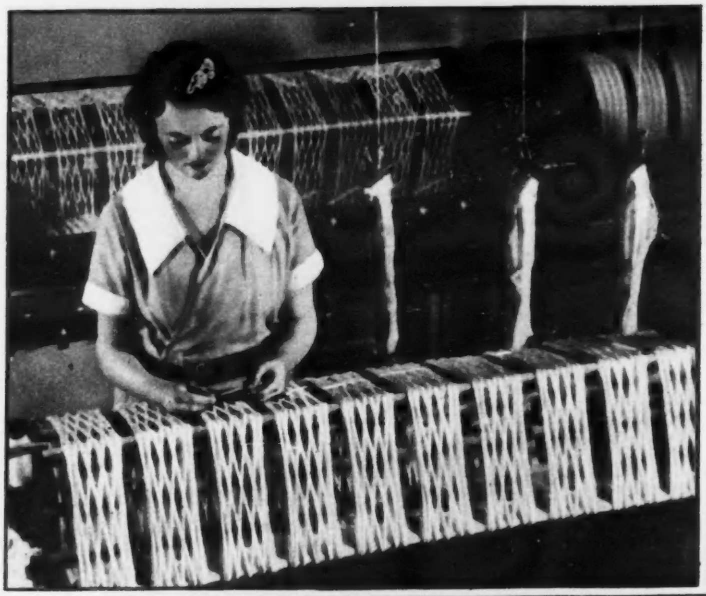
In the beginning, man took the raw materials provided by nature and clumsily adapted them to his needs virtually in their original form. To him, wood was wood and stone was stone. He knew of no way to change them into something else, so he made the best of the basic substances nature offered. Then man made one of his greatest discoveries. He found how to make a fire. And heat, he learned, changed the form of some of nature's products.

Thus was born the era of chemistry.

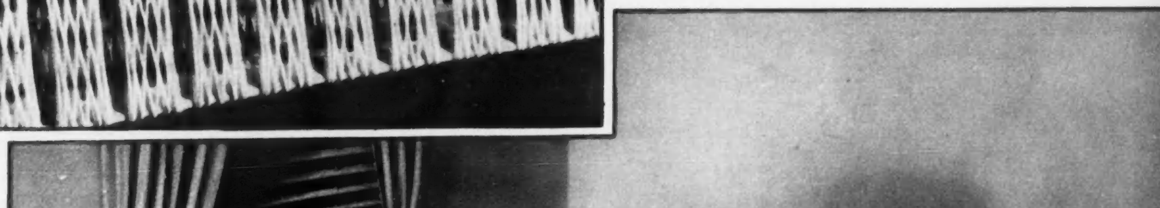
Man began taking apart some of the simpler materials which were his heritage from nature. And, as the centuries passed, he began putting some of these parts together in a different pattern than he had found them. He learned, for instance, how to remove iron from ore with heat. Then he added carbon to the resulting product and obtained steel. He began to identify more and more of the pieces of nature's jigsaw puzzle and fit them together.

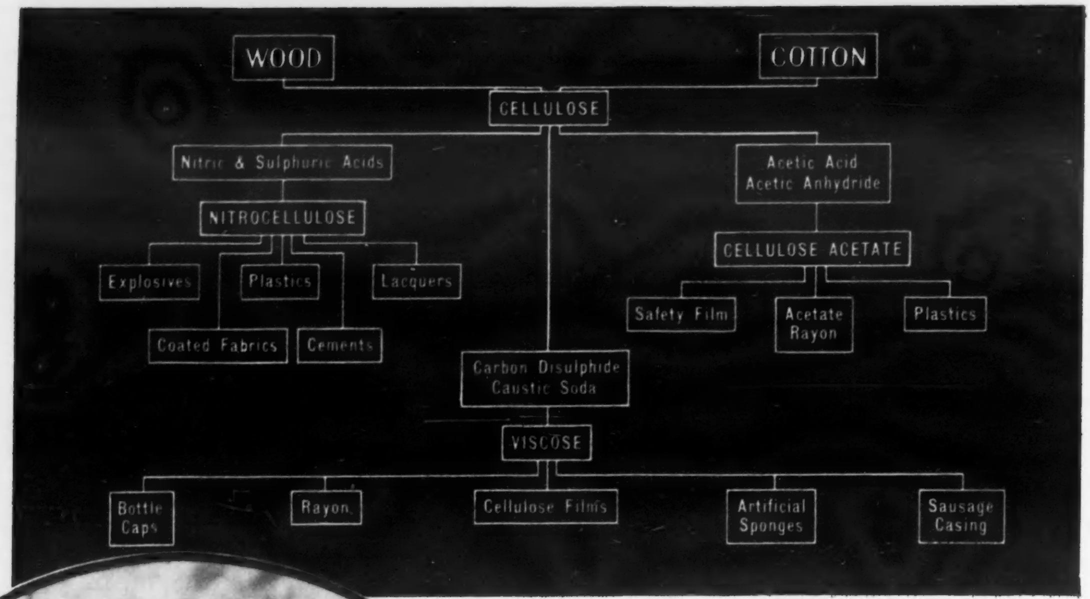
And, strangely enough, man solved some of nature's more complex puzzles before he began to realize what a marvelous chemical storehouse nature had provided in the simple and abundant materials everywhere about him—such common things as wood, air, water, salt, coal and growing plants. He isolated and identified rare elements, then discovered the possibilities hidden in a cornstalk. But, having finally learned the potentialities of these everyday substances, industrial chemists in the past two decades have been making over the world. Products of the farm, the mine, the forest, even the sea and the air have been going to the chemical manufacturer by the millions of pounds and he has transformed these basic materials into new, man-made things of beauty and utility which have added comfort and happiness to our daily lives.

Today, give one of these modern chemists a lump of coal and he will do some re-



WINDING machine in rayon plant. Below, furniture and wearing apparel are products of the chemical laboratory, including the draperies, the upholstery on the chairs, the lamp shade, wall covering, and the gown.





GIRL dressed in water-repellent fabric snow suit which got its start in the chemist's laboratory. Top, the family tree represented by the union of wood and cotton. The first "child" was cellulose and all the other products represented are derived from cellulose in combination with other simple materials.

markable things with it. Or present him with a Christmas tree and he will perform miracles that put Santa Claus to shame. Let's visit the headquarters of the E. I. du Pont de Nemours and Company at Wilmington, Del., one of the world's great chemical manufacturers, and learn how the magic of chemistry converts spruce or cotton into a soft fabric, a flexible lacquer or a durable plastic at the will of the scientist, and how, in like manner, a lump of coal becomes a dye or a perfume.

The secret of scores of modern, man-made substances can be told in one word—cellulose. Cellulose, the fibrous or woody structure of plants, is one of the most plentiful materials produced by nature. Cotton, trees, straws, grasses, cornstalks, sugar cane, flax and hemp all contain cellulose in the form of fibers but for chemical purposes, cellulose is obtained principally from spruce and cotton. The du Pont company alone annually converts about 52,000,000 pounds of cotton and 74,000,000 pounds of wood pulp into cellulose products.

Once the chemist has isolated the cellulose in spruce or cotton with sulfite liquor, made from lime and sulphur, or caustic soda—salt plus electricity plus water—he becomes a modern miracle man. If he treats this

cellulose with nitric and sulphuric acids—nitric acid is ammonia plus air while ammonia is coke plus water plus air, and sulphuric acid is sulphur plus air plus water—he gets nitrocellulose which originally attracted attention as the basic ingredient of smokeless powder. Nitrocellulose dissolves in many solvents to give viscous solutions or "dopes." Spread this dope in a thin layer on a smooth surface and allow the solvent to evaporate and a transparent, flexible film remains.

And that thin, transparent, flexible film revolutionized the automobile industry by making possible today's mass production of cars. A few years ago cars were finished with coat upon coat of slow-drying paints, enamels and varnishes. When the car reached the paint shop, there it stayed for days and weeks as men brushed and rubbed, rubbed and brushed. Chemistry changed all that by producing from nitrocellulose—cellulose, water, air, coke and sulphur—

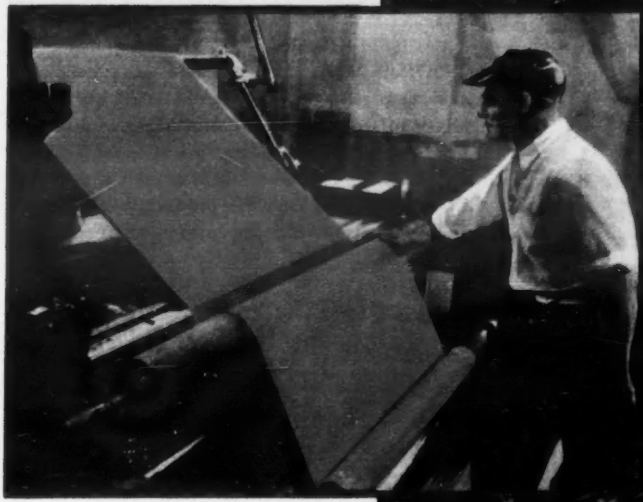
BRIDAL gown of rayon velvet and spools of the man-made fabric called rayon. Top, dressing table with chip-proof finish made on synthetic resin base. Pearl "Pyralin" covers tops of side chests and seat of matching chair.

a quick-drying, long-lasting lacquer which reduced the finishing time from days to hours.

Out of the same substance that covers, beautifies and protects your car, the chemist produces a host of other useful materials by adding softeners and plasticizers to control flexibility, softness, rigidity, suppleness and other characteristics. For coating compositions, he also adds dyes and pigments to lend color. By coating cloth with lacquer, du Pont produces an impervious fabric which can be made to simulate the hide of any animal or the skins of reptiles. Or it can be produced to give an almost unlimited range of decorative effects through the use of artistic designs and color combinations.

This material, known as "Fabrikoid," is used for book bindings and you will find it made into traveling

BLOUSE with colored plastic fastener and, top, smart "Cellophane" boa. Center, battery of mixers used in making the coated textile, "Fabrikoid."



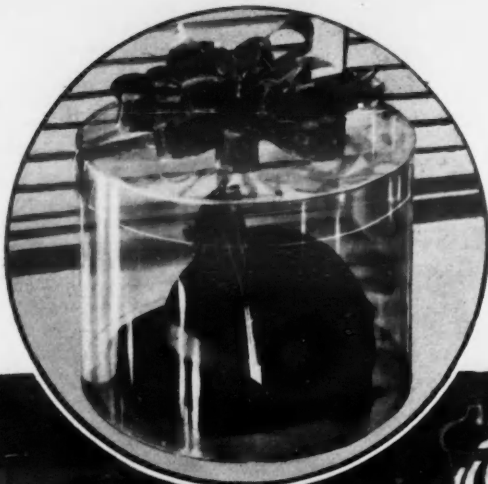
INSPECTING "Fabrikoid" to insure uniformity of grain and color. This material is virtually all cotton, being composed of a cotton textile coated with a solution made from cotton cellulose. Right, the spruce forest and the cotton field supply the raw materials for cellulose products.

Photo at right copyright Asahel Curtis Photo Co.

bags, brief cases, a tablecloth that looks like damask but is soilproof, durable wall coverings, furniture upholstery, coated fabrics for automobiles, window shades which can be washed with soap and water, men's belts, parts for shoes and scores of other products.

Blend camphor with nitrocellulose and you get another material of a thousand uses, not a lacquer but a plastic—"Pyralin." When heated, this plastic can be worked like bread dough and it is produced in rods, sheets and tubes and in all the hues of the rainbow. It forms the "sandwich" between two sheets of shatterproof glass, it is made into toilet articles of beauty and durability, toothbrush handles, advertising novelties, bath fixtures, fountain-pen barrels, toys, automobile trim and articles of office equipment. The elephant and the tortoise should be grateful to the chemist because this inexpensive plastic in its myriad hues gives the beauty, durability and lasting loveliness of ivory tusks and tortoise shells. "Pyralin" is tough, hard, solid, almost unbreakable and can be cut, sawed, filed, blown, rolled, planed, hammered, drilled and turned in lathes without cracking or splintering. Its surface can be made smooth and lustrous, rough or dull. It can be made transparent or opaque, it can be given any color or mottled effect. It lends itself to the exact simulation of mother-of-pearl, ivory, ebony and other natural substances. Its uses are legion in our everyday life.

Now let's return to our old friend, cellulose, the base of all these products. Instead of treating it with nitric and sulphuric acids to produce nitrocellulose, let's add salt to the water, air, coke and sulphur composing the two acids, but let's obtain the ingredients from a different source—lye and carbon disulphide, for example. Caustic soda—lye to you—



TRANSPARENT hat box made of a cellulose acetate plastic. Center, synthetic rubber in an intermediate stage of processing. Bottom, polishing silver with a man-made sponge. This sponge, like rayon and "Cellophane" and "Fabrikoid," is also a cellulose product, another material produced from cotton and spruce.

is salt plus water plus electricity, and carbon disulphide is coke plus sulphur plus heat.

Treat wood pulp with these materials and you obtain, not nitrocellulose, but a sirupy solution known as viscose. Now extrude this sirup through a narrow slit and into a bath of sulphuric acid—sulphur plus water plus air—and you get, not a viscous solution, but a solid—a cellulose film. You know this film as "Cellophane" —the transparent, shimmery, flexible, moistureproof wrapper which protects nearly everything you buy. Even new-born babies are wrapped in this protective covering today. At least one hospital encases the new-born in

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"Cellophane" for protection during handling immediately after birth. But this product of the stately spruce tree is more than a wrapper. It is used for decorative purposes in the arts and crafts, it is made into rain capes and used in colors on hats, shoes and belts and for printing purposes.

Now watch closely while the chemist performs another sleight-of-hand trick. Instead of extruding the sirup through a slit and into an acid bath, he merely squirts it through tiny holes, called spinnerets, and into the acid. And it emerges not as a film but as a filament—microscopic threads finer than human hairs, finer even than the silk of the silkworm. Here you see the birth of rayon, the first man-made fabric. So fine are the tiny strands that one pound of them would reach from the Atlantic to the Pacific but, when woven into yarn, it can be converted into a fabric of chalky crepe or transparent velvet, dull or lustrous, in solid colors or printed designs. Man at last has succeeded in doing mechanically what the silkworm does—making a filament from a plant. The difference is that man uses spruce wood or cotton and works under scientifically controlled conditions; the silkworm takes the mulberry leaves as they come. Moreover, the natural silk filament is a protein material, not cellulose.

New and revolutionary things are being done with rayon today and so widespread have become its applications that the United States alone used more than 250,000,000 pounds of this man-made fabric in 1935, four times the consumption of natural silk. In many minds rayon is associated only with cheap and inferior goods but such is not the case today. Nearly every type of dress fabric today is produced in rayon or by combining rayon with other materials. This is partly due to the fact that the production of rayon can be controlled scientifically to impart any desired quality whereas so-called natural yarns possess certain inherent qualities which the manufacturer must take or leave, he cannot change them.

Rayon, for instance, originally was made highly lustrous. Styles changed and later rayon appeared with chalky and even frosty surfaces. With other yarns such a change would be impossible. The strength and uniformity of rayon yarn have been improved to a point where it is claimed that rayon as irregular as the most regular natural yarns available would be unsalable today. It is also true that more brilliant color effects can be achieved with rayon than with other fabrics because its luster in itself gives added brilliance.

More than 700,000,000 yards of woven fabric were loomed from rayon in 1935, varying from sheer cloths of fine filaments to heavy ones of the wool type, delicate transparent and crushproof velvets, sturdy plushes, smooth sheers, durable rough crepes, satins with a bright glitter and others which were lusterless. Many fabrics are created today which could not be produced at all with other textile fibers and the list is growing. Spun rayon, composed of threads made from cut-up filaments, also has opened up a completely new set of fabrics since it blends with natural fibers to make novelty wools, men's tropical suitings and many other materials.

And still more fabrics are bound to come from cellulose. E. H. Killheffer, executive vice-president of the Institute of Textile Research and an official of the du Pont company, suggests that perhaps some day a method will be found, with the aid of proper buffers, to introduce wool into viscose just before it is extruded into threads or sheets, thus producing a textile fabric after the fashion paper is made. Only time and research will tell.

Various other products besides rayon and "Cellophane" are produced from viscose. Put the sirup into a vat with chemical solids, stir it up and then dump it into the acid bath and it "freezes." Treat the coagulated product to remove the chemicals, thus creating holes where the chemicals were—and you have a sponge. Saw up this product and you obtain a sponge of regular shape in any size desired. Sausage casings and bottle caps also are made from the same sirup.

Now, let's return once more to our starting point—cellulose. Treat this cellulose with acetic acid—which gives vinegar its taste—and you obtain, not nitrocellulose and not viscose, but cellulose acetate and the starting point for a new array of products. Like nitrocellulose, it dissolves in solvents to form viscous solutions, but its solubility characteristics are different. One of its characteristics is that it is slow-burning and hard to ignite so it can be used to make products employed where fire would be a hazard. It goes into photographic film and safety film for movies and as a thin plastic sheet reenforced with

wire mesh it is used instead of glass in poultry houses because it admits ultra-violet light.

It is worked into a plastic somewhat like "Pyralin" and it is made into a fabric, acetate rayon, and converted into high-style women's wear. Acetate rayon is more "immune" to stains of various kinds, perspiration, grease, ink and fruit juices, it absorbs less moisture, it dries quickly after laundering, does not wrinkle easily, resists water spotting, does not yellow with age or exposure to light and will not mildew in the tropics. What natural fabric can boast as many advantages?

Thus has chemistry taken the fibers of growing plants and converted them into useful products seemingly as unrelated as the lacquer on your car, the lining of your coat, the barrel of your fountain pen and the wrapper around your cigar. All are brothers under the skin—their parent was cellulose. The elimination of cellulose products from our civilization today would send us backward toward the Stone Age.

Yet, many of the potentialities of this field admittedly are unexplored. Cellulose may be combined with many acids other than nitric and acetic and it seems probable that patient research in the chemist's laboratory may some day produce a whole new series of cellulose derivatives just as important as the cellulose products we enjoy today.

Truly, the story of cellulose must demonstrate that "things are not what they seem." But this description applies to more than cellulose. What about the rainbow hues of rayons and of the beautiful plastics we use today? That's where the lowly lump of coal enters the picture.

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INVESTIGATIONS OF ORGANIC COMPOUNDS AS INSECTICIDES REPORTED BY DELAWARE AGRICULTURAL EXPERIMENT STATION

EDITOR'S NOTE:- This abstract of Bulletin No. 206 - Technical No. 19, University of Delaware Agricultural Experiment Station, was prepared by the author of the bulletin, Mr. Guy. Copies of the bulletin may be obtained on request to the Agricultural News Letter. Mr. Guy was formerly a research fellow in entomology at the Delaware station.

By H. G. Guy, Entomologist,
Pest Control Research Section,
Grasselli Chemicals Department,
E. I. du Pont de Nemours & Co.,
Wilmington, Delaware.

In May, 1933, E. I. du Pont de Nemours & Co., Inc., established a research fellowship at the Agricultural Experiment Station of the University of Delaware, with the primary object of producing an organic compound as a substitute for lead arsenate that would be non-toxic to man and higher animals, as well as the development of new insecticides for various uses by an exploration of organic compounds. This bulletin is a progress report of the three and one-half years that this project has continued. 800 compounds were tried as stomach poison insecticides, the majority of which had not been previously tested. Every compound which approximated the effectiveness of lead arsenate during this investigation is discussed therein. The majority of these materials were conceived and synthesized by chemists of E. I. du Pont de Nemours & Co., and were submitted to the writer for evaluation as insecticides, either in the pure state or as dusts and sprays.

Five insects were used as indicators for the potential toxicity of these unknown compounds. The insects were the Mexican bean beetle, Colorado potato beetle, codling moth, Oriental fruit moth, and Japanese beetle, and were supplemented by tests against locally available pests. The method of testing, fully described in the publication, follows more or less closely the common procedure with such insects in which several individual insects are confined in a cage with treated foliage, the mortality being determined at a given interval. At the conclusion of the experiments, observations were made on the mortality of insects, the amount of foliage consumed, and plant injury. Any material failing to kill, but preventing destruction of the foliage by such insects, was also considered of promise. Mexican bean beetles were used throughout the year. Japanese beetle tests were conducted by the method developed by Fleming. The compounds were applied in such a manner as to give uniform coverage for each material. The spray apparatus for such applications and the constant temperature chambers used in these investigations are illustrated in this paper. Each compound was diluted as little as possible in its preliminary test in an effort to eliminate the non-poisonous and to detect even a slight degree of toxicity.

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Toxic Chemical Compounds

Representatives of five different chemical groups, namely phosphoniums, coordinated chromium salts, thiazines, thiuram sulfides, and thiocarbamates, equalled the efficiency of lead arsenate in controlling certain insects under laboratory conditions. Although several other compounds were comparable in toxicity to these insecticides, they injured plant foliage severely.

Phosphoniums - Methyl triphenyl phosphonium chloride and methyl triphenyl phosphonium iodide were more effective than triphenyl phosphine, and approached the toxicity of lead arsenate to the Mexican bean beetle and the Colorado potato beetle. Indications are that the increase in valence with the correct additive reagent greatly improves the effectiveness of organic phosphorous compounds. Unfortunately, the successful phosphonium compounds had a tendency to injure plant foliage. In addition, they are rather expensive to manufacture. They were not, therefore, tested under field conditions.

Chromium salts - The coordinated chemical compound piperidinium tetrathiocyanato diammino chromium was the most effective coordinated chromium salt investigated. This compound equalled lead arsenate in the control of all of the test insects, and had a higher speed of lethal action preventing the insects from extensive feeding even at great dilutions. The promising results with this compound under laboratory conditions unfortunately were not duplicated in the field. In the presence of sunlight plus high temperatures, this material decomposed to form possibly a thiocyanate. The products of this decomposition were non-toxic to insects and injurious to foliage.

Attempts were made to stabilize this material, but, to date, they have been unsuccessful. The foliage injury produced was typical in appearance to that made by diluted applications of ammonium thiocyanate. This group of highly toxic compounds, although impractical at present for horticultural sprays, should have other uses as insecticides. No other coordinated compound, tested to date, equalled piperidinium tetrathiocyanato diammino chromium. Guanidine tetrathiocyanato diammino chromium, however, was nearly as effective but also decomposed to form non-toxic phytocidal compounds.

Thiazines - As a consequence of other related investigations maintained by E. I. du Pont de Nemours & Co., the writer tested thiodiphenylamine (phenothiazine). Beginning with the first tests in March, 1934, the results obtained at this laboratory were uniformly promising. This compound dibenzo 1-4 thiazine was the most toxic member of this group. In fact, no analogue of this compound approached its toxicity, with the exception of phenoxthine which injured plant foliage severely. A representative list of such analogues and their toxicity to insects is given in the publication. Thiodiphenylamine is a highly aromatic, light yellow crystalline compound melting at 180°C. and containing a thiazine ring structure bridged by two aromatic nuclei. It is a neutral material difficult to wet, insoluble in water, and appreciably soluble in acetone. It is an unstable compound, and, if the labile hydrogen atom attached to the hetero nitrogen radical is replaced to obtain a stable compound, a material of little or no toxicity is produced. Broadly speaking, substitution in the thiodiphenylamine molecule reduced to a marked degree its toxicity.

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The writer concluded that this compound has contact insecticidal properties and at least is a combination contact and stomach poison insecticide, since its action to many insects even when used as a stomach poison produces a paralytic effect with very little if any feeding. Furthermore, it was slightly toxic to aphids.

Superior to Lead Arsenate

This material was much more effective than lead arsenate in controlling the codling moth, if synthesized correctly. It is especially effective in reducing the number of stings (unsuccessful entries) by these insects. It also controlled the Oriental fruit moth, the Mexican bean beetle, and the Colorado potato beetle.

The most compatible fungicides for use with this material seem to be the flotation sulfurs and the wettable sulfurs. Bordeaux and liquid lime sulfur seriously reduced its insecticidal efficiency.

Under field conditions, this material has been found to be easily removed by rainfall and to oxidize gradually, thereby losing its toxicity. In an effort to overcome such handicaps, and the difficulty experienced in making aqueous suspension of the material, various stickers, wetting agents, and antioxidants were tested. At the present time, under Delaware conditions, no satisfactory spray deposits have been obtained that would remain on the foliage for sufficient time to give good protection of apples from attack by codling moth larvae. Rosin residue emulsion was the most effective sticker investigated. Fish oil, petroleum oil emulsions, and Bentonite were found to be incompatible. Gardinol was the most universally used wetting agent to disperse this material in aqueous dispersions. However, the spray deposit increased as the amount of wetting agent was decreased, provided a good suspension was maintained in the spray tank. Beta napthol was the most satisfactory antioxidant investigated. This material, although failing to equal lead arsenate under Delaware field conditions, has considerable promise, and, if a spray deposit was maintained on the foliage, would give very good protection on the fruit. While failing in the laboratory, it has some promise also as a repellent for Japanese beetle adults under field conditions.

Effect on Foliage

There is little if any difference in the effects on foliage between the various types of thiodiphenylamine studied. This compound when used alone, either as a dust or spray, injured bean foliage, dusts causing the most injury. Tomato, potato, apple, and peach foliage were not injured. The addition of a wettable sulfur did not change these results. Both Bordeaux and fish oil when added to this insecticide caused injury to potato plants regardless of the type of thiodiphenylamine used. There was no discoloration of the apples under Delaware conditions. However, the foliage was slightly darkened by seven applications of this material. With a modified spray schedule and satisfactory spray deposits insured by good stickers, this compound should equal lead arsenate in controlling specific insects on certain crops.

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This material, however, has one disadvantage in that some workers who apply it as a spray suffer a slight skin irritation. This is especially noticeable on hot, humid days.

Repellents Give Good Results

Thiuram sulfides - Several members of this group of chemicals have been found to act as repellents to leaf-feeding insects. The three most successful as repellents were tetra ethyl thiuram monosulfide, tetra methyl thiuram monosulfide, and tetra methyl thiuram disulfide. These compounds were much more effective than lead arsenate in protecting smartweed foliage from destruction by the Japanese beetle adults under the severe conditions of the Fleming method. In fact, tetra methyl thiuram monosulfide at two pounds per 100 gallons was equally as effective as lead arsenate at eight pounds per 100 gallons. The small amount of feeding that did take place was probably due to incomplete spray coverage. These chemicals also prevented the Mexican bean beetle and Colorado potato beetle from feeding.

The most effective under field conditions, however, was tetra methyl thiuram disulfide. This compound at four pounds per 100 gallons gave much better foliage protection than 20 pounds of hydrated lime and was slightly more effective than airfloated derris when used on early apples and peaches. These materials are very safe to use on foliage, produce a much less conspicuous spray residue, and offer, therefore, a much more satisfactory method of preventing Japanese beetle damage than the commonly used lime or lead arsenate sprays since they are non-poisonous to warm-blooded animals.

Thiocarbamates - These compounds also have repellent properties to leaf-feeding insects. However, they are not equal to the thiuram sulfides. They are still in the preliminary stage of investigation, and, therefore, the most effective member may not have been discovered, as yet. Ferric dimethyl dithiocarbamate was possibly the most uniformly effective of these compounds.

Five other compounds were found to be toxic enough to be comparable in that respect to lead arsenate. These materials, however, were not carried beyond the preliminary stages of testing usually because they injured plant foliage. These compounds were the most toxic of their particular chemical group, i.e.- no modification was found to be more effective although it may have been safer for use on foliage.

Non-toxic Chemical Compounds

All materials tested which have not been previously mentioned were either non-toxic or exhibited so little toxicity as to be of no commercial value as stomach poisons. Unfortunately, the chemical compositions of all of these materials cannot be given. However, a large number are listed together with their effect on insects in this bulletin. It may be well to emphasize that all work with such compounds was of a preliminary nature. The conclusions drawn herein are, therefore, but indicative in character. Although 800 compounds have been evaluated,

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the classifications of these materials into toxic and non-toxic groups was arbitrarily done for convenience in presentation. Furthermore, since physical properties as well as chemical composition determine the effectiveness of any chemical, those compounds which exhibit little or slight toxicity may be potentially very poisonous.

Since the majority of these complex organic compounds failed to exhibit strong lethal action, it is obvious that chemical composition only indicated their potential toxicity. No definite clues as to the relationship of chemical composition to possible toxicity was found. There seems to be, however, the possibility that those compounds containing nitrogen, sulfur, and carbon in the correct relationship within the molecule would be the most toxic. Such relationship and the presence of all three elements were not always necessary for an organic compound to be toxic.

NEW LABORATORIES FOR STUDYING INSECTS AND SOILS OPERATED BY THE U. S. DEPARTMENT OF AGRICULTURE

EDITOR'S NOTE:- The thorough and progressive way the U. S. Department of Agriculture keeps abreast of new problems is evident from the announcement below. Information that will be made available as the result of the Department's investigations is certain to prove of great value to all engaged in pest control activities.

On the roof of one of the wings of its South Building in Washington, D. C., seven floors above the street, the U. S. Department of Agriculture has completed the second and last of two glassed-in laboratories or penthouses for research by scientists who occupy offices below. The first, completed last fall, is used as an experimental greenhouse by plant specialists.

This new penthouse laboratory will be used for studying insect pests and specially treated soils, work that needs fresh air and sunshine. Both are a part of original building plans as drawn up several years ago and, strange as it may seem, are not so expensive as such laboratories on the ground nearby would have been. All land close at hand is occupied by business houses, government buildings, or parks.

Facilities for Studying Unidentified Insects

One compartment of the new penthouse is reserved for rearing unidentified insect pests. It has double doors, double screening, and extra strong glass so that no insect can escape. Bolts and locks keep out intruders.

The characters by which many kinds of insects may be identified are known only for the adult stage. It is impossible to identify the immature stages. When living specimens of grubs or other immature stages belonging to groups that cannot be classified are submitted for identification, it is proposed to cage them so they can complete their development, making adults available for study. After getting specific approval, entomologists and plant quarantine inspectors may forward insects in their immature stages in tightly sealed containers to Washington, where they will be reared under these strict quarantine conditions for identification. The association of the immature stages with the adults will give the entomologists information which will aid in combating insect pests and in the enforcement of plant quarantines.

Insects That Attack Man and Animals Studied

Next door to this quarantine room are two compartments used for the study of insects, such as mosquitoes, ticks, and lice, which attack and annoy man and animals. These compartments also are secured against escape of insects and

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against intrusion. Most of these parasites require blood on which to feed and develop, and suitable animals--mice, guinea pigs, and rabbits--are provided for this purpose.

Two problems which will receive early attention are studies on the habits and development of wood ticks because of their relation to Rocky Mountain spotted fever and studies on certain kinds of mosquitoes which are suspected of carrying encephalomyelitis, a serious horse disease. These investigations are designed to furnish more information on the insects. They will not include studies on the disease organisms which they may carry and every effort will be made to exclude insects infected with these organisms.

On the other side of the aisle in the Department's glass penthouse are row upon row of experimental pots, each to hold specially treated soil. Phosphates may have been added to one, arsenates to another, or selenium compounds to another. Corresponding jars, filled with untreated soil, serve as checks. Seeds of a plant selected for the tests are placed in each pot.

The behavior of plants in soils both with and without added toxic substances points the way to overcome natural deficiencies of soils or to nullify the influence of toxic substances like selenium that may occur naturally or like arsenates that may be added by spraying or dusting plants for insect control.

DU PONT PEST CONTROL RESEARCH LABORATORY WILL SEEK SOLUTIONS FOR A WIDE RANGE OF PROBLEMS IN ITS FIELD

EDITOR'S NOTE:- There is now in operation at the Du Pont Experimental Station, near Wilmington, Delaware, extensive facilities for carrying on research and experiments in pest control. Dr. Tisdale tells here the reasons for the establishment of this laboratory and the purposes to which its activities will be devoted.

By W. H. Tisdale, Manager,
Pest Control Research Section,
Grasselli Chemicals Department,
E. I. du Pont de Nemours & Co.,
Wilmington, Delaware.

The opening of this new laboratory does not mark the beginning of the Du Pont Company's interest in the development of pest control products. We hope, however, that it does mark the beginning of a more efficient program of research directed toward a solution of the important pest control problems confronting the country.

Soon after the world war the company, through its Organic Chemicals Department, in seeking promising fields for chemical development began an investigation of the organic mercurials for agricultural uses. From this research developed some valuable seed and soil disinfectants. A subsidiary company was organized in 1928 by du Pont and the Bayer Company to sell the related products of the two companies and to continue research and developmental work on seed, soil and plant disinfectants. This company operates independently of other pest control units in the du Pont Company. In 1930 the Organic Chemicals Department began exploratory research on pest control problems not being considered by the Bayer Semesan Company. In the meantime the du Pont Company had acquired, through purchase, two successful chemical companies who were interested in pest control chemicals. One of these, The Grasselli Chemical Company, had for many years been one of the leading manufacturers of insecticides and fungicides. The other, The Roessler and Hasslacher Company, was a large manufacturer of formaldehyde and cyanide products which are used extensively in the control of pests. These companies also were interested in pest control research.

None of these interested branches of the du Pont Company were adequately equipped for the biological investigations required for a thorough evaluation of chemicals in a search for pest control products. The facilities available were in close proximity to manufacturing plants where the chemical fumes interfered with results. A major part of the biological research was conducted through grants or fellowships at agricultural colleges and State agricultural experimental stations, where valuable contributions were made. Such cooperative projects have many advantages. From the standpoint of a permanent program of research there

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are important disadvantages. Included among them are (1) A division of responsibility for supervising the investigation, (2) The lack of close proximity of the chemical and biological laboratories and the lack of sufficient, much needed, contacts between chemists and biologists, and (3) Important loss, to a permanent development, of trained men due to the temporary tenure of men on fellowship projects.

A Coordinated Research Program

To avoid unnecessary duplication of effort due to over-lapping of interests within the company and to obviate the disadvantages of the arrangements previously mentioned, it was desirable to consolidate the interests of the company and provide adequate facilities for conducting a coordinated research program.

The Grasselli Chemicals Department having the major interests in pest control took the responsibility for organizing and directing the future course of a pest control research program. The Central Chemical research organization of the du Pont Company, the Du Pont Experimental Station, was selected as the logical place for such a development. There are no manufacturing units near to contaminate the air with chemical fumes to interfere with biological activities in the greenhouse and laboratory. The chemists and biologists responsible for the conduct of the investigations function more nearly as a unit. In addition to the chemical synthesis for our program under the supervision of the Experimental Station officials, we also have the advice and assistance of the chemical staff of the Station who are investigating numerous other chemical problems. Through the Experimental Station, which is the central chemical research organization of the du Pont Company, we have ready access to the other research laboratories of the various departments of the company where advice and chemicals are obtained for our investigations. The Haskell Laboratory of Industrial Toxicology is located on the Experimental Station grounds. Expert advice on toxicology and the necessary determination of the toxicity of our pest control chemicals to animal life is obtained through this laboratory. It is very important that we have this information before marketing a product however harmless it may appear in the laboratory.

In addition to our laboratory staff, we also have field research men who test out, under a wide range of regional conditions, such products as appear promising in the laboratory.

Certain applied phases of our pest control investigations are conducted by other departments of the company where it conforms to the needs of certain of their chemical developments.

Solutions of Difficult Problems Sought

Even with the best of facilities the development of satisfactory pest control chemicals is difficult. The numerous kinds of insects, fungi, bacteria, weed, marine growths, rodents and other parasites may react in a different way to chemical treatments. Poison-resistant strains of some of our worst insect pests appear to be developing. Heavier and more numerous applications of the

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poisons are needed for control. Greater danger to human life is involved by the heavier applications of the poisonous products now in use. Removing these poisons from food products is becoming a major problem.

Products must be found that will destroy life and at the same time not destroy life. In other words, the chemical must kill or control the parasite and not harm the host, whether plant or animal. It must be safe to humans who apply the treatment, eat the treated products, or otherwise come in contact with the control chemical. Harmless and valuable insects, fungi, and soil flora should not be destroyed by these chemicals. The fulfillment of such a requirement rests on a very sensitive balance. It depends on taking advantage of the differences in different kinds of living matter - physical as well as chemical factors are involved. Sufficient has been accomplished to indicate that there are many possibilities in the field of organic chemicals which as a rule do not have the cumulative poisonous effects of some of the inorganics. The trend points toward more numerous pest control products developed for specific uses. This complicates a research program. Nevertheless, the more than six billion dollars estimated annual losses caused by pests in our country and the possible losses caused by pests that may yet be introduced from foreign lands justifies any effort that may be made to hold them in check.

OPPORTUNITIES OFFERED GRAIN DEALERS TO INSURE BETTER CROPS AND REDUCE LOSSES FOR CUSTOMERS

EDITOR'S NOTE:- In this article a plant pathologist and scientific research worker offers practical suggestions on the education of grain growers as to the importance of seed treatment. As some county agricultural agents have discovered, the seed dealer can be made a valuable ally in the work of making farming profitable.

By Gilbert F. Miles,
Research Department,
Bayer-Semesan Company,
Wilmington, Delaware.

On the editorial page of The National Grain Journal for January there appeared this sentence: "The thought uppermost in the minds of the delegates was how to encourage farmers to plant better seed." The delegates referred to were those who attended the seed trade meeting at Chicago in January.

Now, I'm not a grain dealer, but that sentence started me to thinking about what grain dealers could do to encourage farmers to produce better grain. And the more I pondered the situation, the more was I impressed with the potential power of country grain dealers to improve the quality and yields of American grain fields. Crop improvements associations, county agents, extension specialists, experiment stations have accomplished much; but none of these agencies has a better opportunity to influence the quality of our grain than the group known as grain dealers. Their daily contacts with grain growers keep them posted on local conditions and the radio informs them of changes in the national market and crop situation. Surely, it seemed to me, a group of men, occupying so strategic a position between the grain growing and the grain consuming trades, could do much to advance the interests of both. But exactly what, I asked myself, can they do? Can I set in black and white just what I would do to encourage the production of better grain, if I were a grain dealer? And so I began to turn over in my mind the things I would do - if I were a grain dealer.

Now let's get it straight. I'm not telling grain dealers what they should do; I've merely accepted my own challenge to set forth the things I would do, or try to do, if I were the grain dealer at Grainville, U. S. A. My own particular approach to the problem will be better understood by the explanation that most of my adult life has been devoted to a study of the ways and means to control plant diseases, including those of grain, and to getting these ideas across to farmers. It is natural, therefore, that the control of diseases should form the foundation of any plan undertaken by me for improving the quality and acre yields of grain in my section. This is not to say that the control of smuts,

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seedling blights, root rots, and other ailments of grain is the only means needed to improve our grain crops. There are many others; but certainly measures looking to the control of these crop losses constitute one of the most important, profitable, and easiest ways by which our American grain grower can supply a better product to the trade and thereby reap larger profits for himself.

With the foregoing explanatory remarks as a background, here is what I would do to encourage better grain production -- if I were the grain dealer at Grainville.

Laying a Foundation

First, I would do a little self-education. I would learn to recognize on sight every important disease of grain that flourished in my section. More than that, I would know the cause of it, the extent of its economic importance in my section, and the most up-to-date means of controlling it. Just for example, I would learn how loose smut of wheat differs from stinking smut, and know why these two diseases of wheat require different methods of control. I would know what causes scabby grain and why state colleges advise disinfection of scabby seed even though such treatment does not keep the next crop from being scabby. A university education isn't necessary for a clear understanding of the answers to these questions. These and many other facts about grain diseases have all been set down in plain language by our state colleges, and a penny post card brings them to you in the form of bulletins. One or two evenings devoted to acquiring such information will make your work as a grain dealer more interesting, and, what's more, it will form the basis of our campaign for better grain.

Having armed myself with a knowledge of the diseases with which grain growers must contend, and with information as to their economic importance in my territory, I would want to know more about the up-to-date methods of checking these costly diseases. In other words, what can grain growers do to prevent these losses?

How Little Losses Mount Up

And let me interrupt your thoughts on this point to remind you that the dockage you deduct for smutty wheat is only a very small fraction of the annual losses sustained by grain growers as a result of diseases in their fields. Nor do the spectacular outbreaks of rust or smut, which occur somewhere almost every year, represent the bulk of these losses. The greatest losses are those which occur in every community year in and year out, and which are caused by moderate amounts of smut, seed decay, root rots, seedling blights, and other troubles resulting in reduced stands and yields and low quality grain. The loss in the average field may easily amount to 5 to 20% of the crop value, and in many cases far more.

But to get back to the problem of controlling these losses, my quest for information on the subject would bring me quickly to the matter of seed treatment. Great strides have been made in the art of seed treatment during the past few

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years. Modern chemistry has provided simple and inexpensive means of disinfecting seed grains to prevent most of the more serious diseases. If your information on the subject is five years old, it is out-of-date.

To mention some of the recent improvements, let me say that farmers no longer use one chemical for treating wheat and a different chemical or another method for treating oats. It is now possible to purchase one dust disinfectant and to use it in exactly the same way on wheat, oats, and barley. Scientific study has lowered the cost of seed disinfection to a few cents per acre and has so improved the physical properties of the treatments that reduced planting rates, clogged drills, and drill breakage are a thing of the past. High speed treating with gravity machines has replaced the slow laborious methods formerly required. Treaters for farm use with a capacity of 50 to 100 bushels of seed per hour can be built at a cost of five or six dollars. Seedsmen and elevators use larger outfits that handle up to 500 bushels of seed grain per hour. Information regarding seed treating equipment can be obtained from various sources: manufacturers of such machines and seed disinfectants, state colleges, county agents, and farm and trade papers.

The Value of "Sight Appeal"

The next step in my campaign would be to persuade farmers that it will pay them to control their grain diseases. Persuading others to do what we want them to do is no simple task, and so I should plan to use more than one line of attack. Of course, I would take advantage of every conversation in which the problem of plant disease control was mentioned to emphasize the need for checking these losses. Here is where my acquired knowledge on the subject would stand me in good stead. Farmers are quick to spot a windjammer, but they are ready to listen attentively to a man who has the facts and can express them in their own language. My contacts with grain growers would afford me daily opportunities to get my ideas across to them, and I would lay the foundation of my plan during these talks.

Talking is one method of presenting ideas to another, but it usually requires more than verbal persuasion to get action from farmers. Like most other men they are often more quickly convinced and prompted to action by what they see than by what they hear. And so I would not depend on conversation to do more than introduce the subject; I would appeal to their eyes as well as to their ears.

From my supply of bulletins and circulars on grain diseases and their control I would select one or two with the most appeal. They would be the ones that told the story in simple language, explained the most up-to-date methods of seed treatment, and which above all were interesting in appearance. The state colleges which publish the bulletins selected will be glad to supply you with a dozen or more copies if you explain you wish to distribute them among your grain growers. These publications can be kept on hand and in sight in your office. When the question of grain diseases arises, the bulletins will back up your statements, and the copy that goes home with the farmer will provide your excuse at the time of his next visit to follow up the matter by asking him if he has read it.

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About this time some of you are thinking that the chances are the farmer will use the bulletin to start the kitchen fire in the morning. Sure, some of them will. I don't expect to land all these grain growers at one time. If at my first attempt I could persuade only one farmer in my community to adopt sound methods of eliminating his plant disease losses, I would mark it as a victory. One farmer a victory, why? Because I know that good farm practices are not confined by the best hog-tight fence ever made; they have a way of spreading throughout a community, like measles in a country school. Farmers learn a lot by watching their more progressive neighbors. So don't be discouraged if you find your pretty bulletin stuck behind a studding in the elevator. No salesman expects to sell every potential customer he calls on; he just acts as if he did. No manufacturer advertising in a magazine expects every subscriber to read every line of his advertising. He knows, however, that a large percentage of readers will see his advertisement, and that if his product has the right quality and the right price, effective advertising will start the orders coming and keep them coming.

Your campaign to reduce grain disease losses among your farmers is based on sound facts and the experience of thousands. Furthermore, in no other way can farmers do as much to increase their grain profits at such small cost as by treating their seed to eliminate losses by disease. So the idea you are selling grain growers has the right quality and the right price: if your advertising is effective, you cannot fail.

A Convincing Demonstration

But getting back to our job of selling better grain growing to our farmers, there are other things we can do besides talk and pass out bulletins. For one thing, you can run an interesting and convincing demonstration on the value of seed treatment right on a table in your store or office. Ten or fifteen minutes spent in starting the test will enable you to show grain growers something that not one in a thousand has ever seen. It will be a hard-boiled man, indeed, who can pass up the chance to ask about it.

First, treat a measured pint or quart of seed wheat, oats, or barley. You must use approximately the correct amount of dust disinfectant, but you don't need any fancy equipment to weigh out the small amount of dust required. The most commonly used dust disinfectant is used at the rate of only one-half ounce of dust per bushel of seed. In each container the manufacturer supplies a measuring spoon, which holds level full about one-half ounce of dust, the amount needed for one bushel of seed grain. Now, if you plan to treat a pint of seed, you need only one-sixty-fourth (1/64) of a spoonful, because there are 64 pints in a bushel. To measure out this amount with fair accuracy, take one level measuring spoonful and place it in a regular shaped pile on a piece of newspaper. Divide the piles into halves, then divide one half into quarters, divide one-quarter into eighths, one-eighth into sixteenths, one-sixteenth into thirty-seconds, and one-thirty-second into sixty-fourths. And there you have one-sixty-fourth of a measuring spoonful, or enough dust for one pint of grain. It takes faith to expect that tiny pile of dust to destroy the smut spores on a pint of seed; but that is all that is needed, so don't use more. To do so will probably ruin your test.

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Now place your pint of seed in a clean, quart fruit jar, coffee can, or similar container. Add the tiny pile of dust carefully, place the cover on the container, and shake the seed and dust together for a minute or so. If you can let the seed stand in the container with cover removed until the next day, it will be better. If not and you are in a hurry, go ahead with the next step.

Buy, beg, or borrow a couple of pie pans or similar trays. Fold several thickness of paper towels, newspapers, or clean cloth and place in each tray. Add enough water to saturate thoroughly the paper or cloth, and then pour off the excess water.

Now you are ready to plant your seeds. Don't use your fingers. The moisture and oils of the skin tend to remove the dust from the seed. Scatter twenty-five or fifty of the treated seed in one tray and about the same number of the same kind of seed, but untreated, in the other tray. Cover the two trays with newspaper, a piece of clean cloth, or, better still, a couple of pieces of window glass. Keep the trays in some place warm enough to promote germination. In three or four days it is probable you will notice molds or fungi growing all over the untreated seed, while the treated seed will be comparatively free from molds. This little test provides an impressive demonstration of how seed treatment destroys the spores of disease organisms, such as smut on the surface of the seed. Give your farmers a peek at the test and watch their curiosity.

Making Seed Treatment Easy

So far we have been merely working up interest in the matter of better grain through seed treatment. Let's make it as easy as possible for grain growers to adopt these disease control practices we are recommending. Why not keep on hand one of the gravity seed treaters now so widely used? Your blacksmith or tinsmith can make one from a discarded oil drum for five or six dollars. Or, if you have a few hours spare time, you yourself can make one. Use it to show grain growers how quickly seed can be treated. If they haven't seen one of these gravity treaters in operation, its simplicity and labor saving feature will revolutionize their ideas about the work involved in treating seed. Blueprint patterns for making a gravity treater can be secured through your county agent or on request to the writer. The step-by-step directions are easily followed. After seeing your gravity treater, many growers will want to borrow it. Lend it to them for a nominal charge, say 35¢ a day, or, better still, show them how easy it is to make one for themselves.

Many elevators are now offering a seed treating service. They supply the disinfectant and treat the seed, charging enough for the dust and the service to return a very nice profit to them. Seed treaters capable of treating a truckload of seed in a few minutes can be installed for a relatively small investment.

A Service to Grain Growers

Even though you are not in position to render a seed treating service to

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farmers, you can lay in a small stock of seed disinfectants to supply the demand for such materials by grain growers. Or, if that is not feasible you can see to it that some reliable dealer in your community does carry a supply of such products.

One other way in which you can advance the grain growing business in your territory is by encouraging the establishment of custom seed treating service, which is now developing rapidly in many sections. Briefly described, a seed cleaner and treater are mounted on a truck, which travels from farm to farm cleaning and treating seed for a fixed price per bushel.

The idea is new or unknown in many districts, but requires only a suggestion to the right man to get it started. Custom treaters who began with a single outfit only a few years ago are in some cases now operating six or eight outfits and covering many counties in important grain growing states. Only a small investment is needed and a conscientious operator can easily build up a nice business in his county.

Summing up the various steps in our campaign, we began with self-education on the subject of grain diseases, their economic importance, and their control. The next move was to begin passing this information on to grain growers in our conversations with them, supporting our statements with literature from the state colleges.

Next come the use of simple germination tests conducted in the office to show how seed treatment checks the growth of seed-borne parasitic organisms like those of the smuts and other diseases. We then followed up the tests or demonstrations with the gravity seed treater to serve as an exhibit or model, or to be rented to growers. At the same time we made certain that a supply of seed disinfectants was available in our community. As more advanced steps the installation of a seed treating service, or the establishment of a traveling custom treating service were suggested.

Possibly by this time you may be chuckling to yourself that the grain dealer at Grainville has bitten off more than he can chew if he expects at the same time to stay in the business of buying and selling grain. If, however, you will consider again my various suggestions for improving grain production through seed treatment, you will note that none of them has required much time or work on my part; I have supplied the leadership, but very little actual time-consuming work. Knowledge of the problem, suggestions, initiative, and leadership are needed to start the ball rolling. After that is accomplished, you will find many others willing to lend a hand and to keep it rolling.

FEDERAL AGENCIES USE DYNAMITE TO BLAST SPRINGS TO PROVIDE WATER FOR CATTLE ON WESTERN RANGES

EDITOR'S NOTE:- The work of opening springs and otherwise making water available for cattle, described in the statement of the U. S. Department of Agriculture, further emphasizes the importance of the activities of the Soil Conservation Service and CCC camps. Mr. Livingston's suggestions on blasting water storage ponds should prove helpful to those engaged in work of the character now being done by Federal agencies.

By. L. F. Livingston, Manager,
Agricultural Extension Section,
E. I. du Pont de Nemours & Co.,
Wilmington, Delaware.

Blasting to check soil erosion may seem far-fetched, yet that is exactly what the Soil Conservation Service is doing in the John Day range country of northern Oregon, according to the U. S. Department of Agriculture.

"Here there were only a few scattered water holes around which the soil was bare because of overgrazing and trampling. To distribute the livestock more evenly, the Service-with the aid of one CCC camp-blasted open more than 40 new springs among the hills.

"At various places in the bottom land where there was seepage or other indication of water near the surface, explosives also were used to blast open a new spring and create a small basin for collecting the water. The springs were then covered or fenced to protect them from the trampling animals. Trees were cut, hollowed out, and laid end to end as watering troughs.

"Spreading the animals more evenly over the range thickens the forage cover which protects the soil against erosion and makes it more porous and absorptive.

"In other sections of the western range country, the Service is cleaning out existing springs or changing fences to limit the number of animals watering at a hole. As in the John Day country, the springs are protected by fences or covering and watering troughs are built," the Department reports.

Storage Shares Importance With Water Supply

Equally as important as the availability of water from springs or other sources is the conservation of water. Storage of surplus water may be effected by providing ponds or water holes to retain water not needed immediately.

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Usually, it is good policy to make reservoirs deep, not alone for capacity, but also to retard evaporation by reducing the surface area. A shallow pond, with capacity equal to a deep one, necessarily must cover a larger area and the rate of evaporation is proportionately more rapid. This has been shown by surveys made by the Department of Agriculture.

Location is an important consideration. Where there is a grade, the pond should be made below the spring or other source of water. In cases, a ditch can be made to carry the water to the storage basin.

Method of Blasting a Deep Pond

It is the practice of agricultural engineers to use the so-called post-hole method for blasting deep ponds. This method takes its name from the fact that holes similar to fence-post holes are required to hold the relatively large charges of dynamite. Too, the holes are made with a post-hole auger.

A pond of any length can be made by the post-hole or any other method of blasting. All that is necessary is to increase the number of holes. Width and depth are the factors to which attention must be given.

Where the ground is sufficiently wet, a 7-foot depth pond -- with a bottom width of seven feet and a top width up to 21 feet -- can be shot by loading holes with 30 sticks (15 lbs.) of ditching dynamite. The dynamite should be tied in a bundle. A 6-inch diameter hole should be made to a depth of five feet. The holes should be located on the center-line of the proposed pond and spaced 4½ feet apart.

For shooting in wet ground, it is necessary only to prime a single stick of ditching dynamite in but one of the holes. The detonation of the initial hole will, by propagation, set off the ditching dynamite in all the other holes. Priming may be done with a blasting cap and fuse, but the use of an electric blasting cap, to be fired by a blasting machine, is the preferred method.

Precautions to be observed include making certain that, after loading, holes are filled with water or earth tamping; the use of sufficiently long fuse, or leading wires for the blasting machine for the blaster to take a safe distance. When a blast is fired there always is danger from flying lumps of earth, especially if wet, and there is stone in the soil.

Specifications for Post-Hole Loading with Ditching Dynamite

Number of sticks per hole	6	10	20	30	50	100
Number of pounds per hole	3	5	10	15	25	50
Distance between holes--feet	3	3-1/2	4	4-1/2	5	6
Depth of Pond--feet	4	5	6	7	8-1/2	12
Bottom width of Pond--feet	4	5	6	7	8-1/2	12
Top width of Pond--feet	12	15	18	21	25-1/2	36
Depth of load--feet	2-2/3	3-1/3	4	4-2/3	5-2/3	8
Diameter of Post Hole--inches	4	4	6	6	8	8
Dynamite per rod--pounds	16-1/2	23-1/2	42-1/4	54-3/4	82-1/2	138
Dynamite per 100 feet--pounds	100	142-1/2	250	333	500	833
Materials moved per rod--cu. yds.	19	30.6	44	60	88	176
Materials moved per 100 feet--cu.yds. ..	118	185	266	363	533	1067

Note: Cartridges, or sticks, are 1 1/4" x 8"

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AN INTERESTING AND VALUABLE SUPPLEMENT IS PRESENTED TO READERS OF THIS NUMBER

Through the courtesy of POPULAR MECHANICS MAGAZINE, Chicago, we are enabled to present to readers of the AGRICULTURAL NEWS LETTER an interesting and interpretative discussion of modern industrial chemistry.

This article, in two parts, appears in the June and July issues of the magazine. The first part is used as a supplement to this number of the news letter. The concluding part will be issued as a supplement with the July number. It may, however, be obtained earlier, since the second part is printed in the July issue of POPULAR MECHANICS MAGAZINE, now on sale at newsstands.

Mr. Harley William Magee, of POPULAR MECHANICS MAGAZINE, obtained the information for his highly informative article in personal interviews with scientists of E. I. du Pont de Nemours & Company during a visit to the headquarters in Wilmington, Delaware.

This article is commended to teachers and students of chemistry and others. It is a distinct contribution to a better understanding of the many achievements of scientific research and the progress being made by the American chemical industry. It exemplifies the true meaning of "Better Things for Better Living -- Through Chemistry".

NOTE: Mr. Magee's article is offered only with copies of the AGRICULTURAL NEWS LETTER distributed in the United States. However, copies will be sent on request to foreign readers.